**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC**

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|---|---|---|
| In the Matter of Use of Spectrum Bands Above 24 GHz For Mobile Radio Services | ) | GN Docket No. 14-177 |
| Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands | ) | IB Docket No. 15-256 |
| Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band | ) | RM-11664 |
| Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services | ) | WT Docket No. 10-112 |
| Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations | ) | IB Docket No. 97-95 |

# COMMENTS OF NEXTLINK WIRELESS, LLC

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## Executive Summary

Wireless network operators in the United States are poised to lead the global development and deployment of 5G services in the same way they led in 4G. To this end, the Commission has taken considerable steps to unlock millimeter-wave ("mmWave") spectrum for next-generation services. Most recently, the Commission proposed technical and service rules for a variety of spectrum bands reaching as far up as 95 GHz. But while the Commission has identified a number of promising, high-frequency spectrum bands as suitable for 5G services, it should not lose sight of existing bands, already allocated for mobile use, that are well-suited for 5G services. Nextlink looks forward to continuing to work with the Commission and other stakeholders to further improve the rules for flexible use of mmWave spectrum and maximize the amount of spectrum available for 5G applications and services.

The LMDS A2 (29.10-29.25 GHz) and A3 (31.075-31.225 GHz) bands and B block (31.00-31.075 GHz and 31.225-31.30 GHz) are ideally suited for 5G service. These spectrum bands are already allocated for mobile use and are much lower in the frequency range than other, higher-band frequencies the Commission identified in its *Further Notice*. Realistically, the A2 and A3 bands and B block are much stronger candidate bands for mobile use than most of the new higher frequency bands suggested by the *Further Notice*, and can more quickly unleash the powers of 5G technologies. The record reflects strong support for adopting mobile service rules for these bands, and several international regulatory agencies agree. The Commission should immediately adopt such rules.

The Commission's only justification for not adopting mobile service rules for the remaining portions of the LMDS band is that the segments do not offer at least 500 megahertz of contiguous spectrum. However, the record establishes that this restriction is not tied to any technical requirements for 5G services. Indeed, the Commission disavowed this gating criterion when it proposed applying its Part 30 rules to bands significantly smaller than 500 megahertz in bandwidth in the *Further Notice*.

Adopting mobile service rules for the remaining LMDS bands would create multiple public interest benefits while avoiding the tangible harms that licensees would face if these bands are not put to mobile use. Equipment manufacturers are unlikely to focus their attention on the remaining LMDS bands, which will drive up equipment costs (if not eliminate equipment altogether). Moreover, not adopting mobile service rules for the entire LMDS band will create confusing and burdensome regulatory requirements for licensees. The Commission can complement its efforts to spur 5G services by harmonizing the LMDS band and adopting mobile service rules for the 28 GHz A2 and A3 bands and B block.

Further, the performance requirements and sharing mechanisms proposed in the *Further Notice*, if adopted, will derail the Commission's hard work to identify mmWave spectrum bands for 5G and to adopt flexible use rules. The Commission must balance its performance requirements in a manner that provides licensees with regulatory certainty but also adapts to the

many new 5G technologies and business models that will develop over time. No one can predict the exact mix of revolutionary technologies that will operate over 5G networks deployed in mmWave spectrum bands. Attempting to create rigid, *ex ante* performance requirements years before 5G technology is standardized is a recipe for disaster. Likewise, clear, technology-neutral rules that do not discriminate against one technology over another are preferable to the administrative burdens that *ad hoc*, case-by-case reviews of thousands of licenses would create. A procedure mandating periodic review of applicable performance requirements would ensure that the Commission's rules do not get ahead of (or become inconsistent with) technological developments. Similarly, a vaguely defined and untested "use-it-or-share-it" regime, if adopted, would complicate the roll-out of 5G services, encourage inefficient use cases and reward speculators that "sit on the sidelines" while others invest in R&D and equipment production at the beginning of the 5G development cycle. At a minimum, a use-or-share regime must provide licensees with maximum flexibility in building their networks and providing connectivity for next-generation products and services.

Finally, Nextlink offers some refinements to the Commission's proposed technical rules. Specifically, Nextlink urges the Commission to (1) refrain from scaling downward the maximum power limits for mobile and transportable stations; and (2) adopt alternatives to existing coordination distances for fixed point-to-point operations that reduce the burdens of coordinating fixed links.

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**COMMENTS OF NEXTLINK WIRELESS, LLC**

Nextlink Wireless, LLC ("Nextlink"), through its undersigned counsel, hereby submits these comments in response to the Federal Communications Commission's ("FCC's" or

"Commission's") Further Notice of Proposed Rulemaking ("*Further Notice*") in the above-captioned proceedings.[1]

## I. INTRODUCTION

Nextlink supports the Commission's efforts to make more spectrum available for the deployment of mobile broadband, Internet of Things ("IoT") technologies, and other revolutionary next-generation services. While the *Further Notice* focuses on new spectrum bands that may be suitable for 5G, the best and most comparable spectrum is still available in the LMDS bands, and the Commission should seize the opportunity to identify and target these well-situated bands for development. The Commission should also establish a more flexible licensing and regulatory framework for the newly designated 5G spectrum; a regime that allows innovation, not performance requirements, to drive the development of 5G will better promote deployment in those bands.

Specifically, in its *Further Notice*, the Commission seeks comment on additional bands that may be suitable for flexible fixed and mobile uses and on refinements to the service rules the Commission adopted in the *Report and Order*.[2] While the Commission has teed-up several millimeter wave ("mmWave") bands for flexible use (reaching as far as 95 GHz and beyond), Nextlink urges the Commission to also allow mobile broadband use in the remainder of the LMDS band. The Commission took a significant step forward when it adopted mobile service rules for the 28 GHz A1 band; it should now adopt mobile service rules for the remainder of the band to optimize use of this valuable spectrum.

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[1] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd. 8014 (2016) ("*Report and Order*" or "*Further Notice*").

[2] *Further Notice* ¶ 369.

In addition, Nextlink urges the Commission to adopt a balanced approach to performance obligations that encourages the deployment of 5G technologies, reduces the likelihood of uncertainty, and promotes investment. Finally, Nextlink offers targeted comment on several of the technical rules proposed in the *Further Notice*.

Nextlink remains committed to working with the Commission to target additional mmWave spectrum for 5G services. With the right service and technical rules in place, the United States will lead the world in the development and deployment of 5G services in the same way it has led in 4G deployment.

## II. THE 28 GHZ A2 AND A3 BANDS AND B BLOCK ARE WELL-SUITED FOR MOBILE BROADBAND USE.

The *Further Notice* seeks comment on a number of additional spectrum bands the Commission can target for flexible fixed and mobile use, stretching as far as the 95 GHz band and beyond.[3] In seeking comment on these higher mmWave bands, the Commission should not pass over the "low-hanging fruit" in the remainder of the 28 GHz band. Adopting mobile service rules for the 28 GHz A2 and A3 bands and B block would make 450 MHz of additional spectrum available for next-generation services. By contrast, the Commission's current approach will fracture the LMDS band, lead to inefficient use of spectrum, and drive up equipment costs for LMDS licensees.

### A. Adopting mobile service rules for the 28 GHz A2 and A3 bands and B block would serve the public interest.

The A2 and A3 band and B block of the LMDS band are strong candidates for flexible use rules for several reasons. First, the LMDS band consists of lower-frequency mmWave

[3] *Further Notice* ¶¶ 373, 442-45.

spectrum that—like the A1 band—will propagate better than higher mmWave frequencies. Second, several parties here in the U.S. and internationally have advocated in favor of adopting mobile service rules for the entire LMDS band. Third, stakeholders agree that many next-generation services are likely to require significantly less bandwidth than the 500 megahertz channels that the Commission initially used in selecting additional bands for consideration.

### 1. The 28 GHz Band is already allocated for mobile use and is lower in frequency than other candidate bands.

As an initial matter, the 28 GHz A2 and A3 bands and B block are already allocated for mobile use, making them a natural target for Commission action.[4] In addition, the LMDS band is lower in the frequency range than most of the other bands the Commission seeks comment on in the *Further Notice*. The band has lower atmospheric absorption than higher mmWave frequencies, such as 60 GHz, making the 28 GHz band comparable to the 1 and 2 GHz bands used for cellular service in terms of proportional free space path loss.[5] The band also is substantially unaffected by rain attenuation and oxygen loss, and may even offer better propagation conditions than today's cellular networks throughout each cell.[6] As a result of its

[4] *See* 47 C.F.R. § 2.106.

[5] *See* Hang Zhao *et al.*, *28 GHz Millimeter Wave Cellular Communication Measurements for Reflection and Penetration Loss In and Around Buildings in New York City*, 2013 IEEE International Conference on Communications, at 1 (June 2013) ("Zhao Paper"), *available at* http://faculty.poly.edu/~tsr/Publications/ICC_2013_Celinev2.pdf (explaining that the 28 GHz band and the 1-2 GHz frequencies obey the theoretical free space loss formula because both are relatively unaffected by external factors so will measure close to their respective values as predicted by the theoretical formula, whereas for higher frequencies, real world measurements of the losses will always be greater than predicted by the formula due to higher atmospheric absorption).

[6] *See id*. The small cell size and high-gain-adaptive antennas of 5G networks will allow propagation conditions to be more consistent across the small cell's coverage area than in today's macro-cellular networks, where a user's experience is much more variable within a given cell's coverage area.

propagation advantages over higher mmWave bands, the LMDS band would require fewer sites and less infrastructure investment to deploy 5G services than the other bands. In light of these benefits, the Commission should prioritize the lower frequencies in the LMDS band for next-generation services, including mobile service.

### 2. Parties to this proceeding and international regulators support adopting mobile service rules for the remaining portions of the LMDS band.

Parties to this proceeding support targeting the A2 and A3 bands and B block for 5G. As Ericsson previously noted, "the LMDS bands at 28 GHz will be of particular interest to the mobile industry for systems that may follow 4G into higher frequency bands."[7] According to Ericsson, the entire band from 27.5 GHz to 31.3 GHz "can probably be handled by an integrated radio," meaning that device manufacturers can build equipment capable of using the entire LMDS band at marginal additional costs.[8] Mobile Future has similarly urged the Commission to "continue aggressively pursuing the other spectrum bands above 24 GHz, including but not limited to" the A2 and A3 bands and B block.[9] Telecommunications regulatory authorities in other countries—including Australia, Finland, and Sweden—have also expressed interest in using the LMDS band for deploying 5G services.[10] The Commission should follow suit and adopt flexible use rules for the remaining portions of the LMDS band.

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[7] Comments of Ericsson Inc., GN Docket No. 14-177, RM-11664, at 37 (filed Jan. 15, 2015) ("Ericsson Comments").

[8] *Id.*

[9] Comments of Mobile Future, GN Docket No. 14-177, *et al.*, at 9 (filed Jan. 27, 2016).

[10] *See, e.g.*, 4G Americas, 5G Spectrum Recommendations, at 9-10 (Aug. 2015) (noting Australia, Finland, and Sweden have proposed 31-31.3 frequencies for 5G); http://www.4gamericas.org/files/6514/3930/9262/4G_Americas_5G_Spectrum_Recommendations_White_Paper.pdf; Japan and Singapore proposal on WRC-15 Agenda Item 10: A WRC-19 New Agenda Item for Identification of IMT in the Frequency Band(s) Above 6 GHz, at 9 (July

### 3. Spectrum channels smaller than 500 megahertz in bandwidth can support next-generation services.

The A2 and A3 bands and B block meet three out of the four criteria the Commission set in its original Notice of Proposed Rulemaking ("*NPRM*") for targeting bands for mobile use. The bands: (1) are being considered internationally for mobile service; (2) are compatible with existing incumbent license assignments and uses; and (3) can accommodate a wide variety of services.[11] The only criterion the A2 and A3 bands and B block do not meet is the FCC's original threshold that the bands contain at least 500 megahertz of contiguous spectrum.[12] But that proposed threshold is not based on any technical requirement for 5G deployment; the record evidence establishes that operators will be able to deploy next-generation services over channels significantly smaller than 500 megahertz, and the Commission should not give up on the remainder of the LMDS band simply because it does not contain the Commission's desired amount of contiguous spectrum. Indeed, the Commission seems to have moved away from this metric in the *Report and Order and Further Notice*: the Commission declined to propose service rules for the 24 GHz band in its *NPRM* because it lacked 500 megahertz of contiguous spectrum, but proposed rules for the band in its *Further Notice* based in part on commenters' recognition that "not all use cases require 500 megahertz of spectrum."[13]

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20, 2015), http://www.aptsec.org/sites/default/files/2015/07/APG15-5-INP-35_JSNG_AI10-IMT.docx.

[11] *Further Notice* ¶ 370 (citing *Use of Spectrum Bands Above 24 Ghz for Mobile Radio Servs.*, Notice of Proposed Rulemaking, 30 FCC Rcd. 11878 (2015) ("*NPRM*")).

[12] *Id.*

[13] *Id.* ¶ 381.

5G services can be deployed over bandwidths smaller than 500 megahertz.[14] Even using bandwidths smaller than 500 megahertz, the performance of 5G technology will provide users with exceptional data speeds that far surpass the capabilities of current 4G technology.[15] For example, 4G LTE-Advanced technology theoretically enables peak rates of 3 Gbps in the downlink and 1.5 Gbps in the uplink using a 100 megahertz downlink channel and a 100 megahertz uplink channel.[16] This equates to a peak spectral efficiency of 30 bps/Hz in the downlink and 15 bps/Hz in the uplink. 5G technology will exceed this level of performance and will provide even higher peak rates in the equivalent channel bandwidth because high gain adaptive antennas will enable higher-order modulation (256QAM) and the smaller wavelengths

[14] *See, e.g.*, IEEE Communications Magazine, *Applications of Self Interference Cancellation in 5G and Beyond*, at 114 (Feb. 2014); Ericsson Comments at 37; *See* Reed Engineering, *Maximizing the Utility of the Upper Microwave Flexible Use Service Bands Via Licensee Flexibility and Sound Spectrum Usage Policies*, at 7 (Jan. 26, 2016) ("Reed Paper"), *attached to* Comments of XO Communications, LLC, GN Docket No. 14-177, *et al.* (filed Jan. 28, 2016) ("XO Comments") (stating that a data rate of more than 1 Gbps is achievable over a 100 megahertz channel with 4G air interface specifications, and even higher data rates would be achievable over a 100 megahertz channel with 5G air interface specifications); XO Comments at 7.

[15] *See* XO Comments at 7; Reed Paper at 7 & n.8; Yinan Qi *et al*., *Quantifying Data Rate and Bandwidth Requirements for Immersive 5G Experience*, Samsung Electronics, at 1 (2016), https://arxiv.org/ftp/arxiv/papers/1605/1605.03331.pdf ("5G experiences should come with a distinct improvement in Quality of Experience (QoE) compared to that in the (then) legacy 4G services. For the immersive multi-media experiences, the 'user experienced' data rates, latencies and other key KPIs should indicate a step change from the (then) 4G evolutions."); Michale Nunez, *What is 5G and How Will It Make My Life Better?*, Gizmodo (Feb. 24, 2016), http://gizmodo.com/what-is-5g-and-how-will-it-make-my-life-better-1760847799 (reporting 4G maximum download speed is about 1 Gbps while 5G can reach up to 10 Gbps).

[16] *See* Reed Paper at 7 & n.8 (data rates assume aggregation of five 20 megahertz LTE carriers and the use of (8x8) MIMO and 64-QAM in the downlink and (4x4) MIMO and 64-QAM in the uplink). Although this level of aggregation and these higher-order MIMO configurations are not currently practical to implement, they are supported by the 3GPP standard for LTE-Advanced and thus represent an upper limit of current 4G technology. *See, e.g.*, Jeanette Wannstrom, *LTE-Advanced*, 3GPP (June 2013) ("3GPP LTE-Advanced"), http://www.3gpp.org/technologies/keywords-acronyms/97-lte-advanced ("A major change in LTE-Advanced is the introduction of 8x8 MIMO in the DL and 4x4 in the UL.")

of higher frequencies will reduce antenna size, removing the practical barriers to deployment of "massive MIMO."[17] Therefore, 5G is expected to have better peak spectral efficiency than 4G technologies, and users can expect much better data rates than those supported by the current 4G standard, even for bandwidths less than 500 MHz.

The A2 and A3 bands and B block in the 28 GHz band therefore are suitable for mobile broadband, despite the fact that the channel bandwidths are smaller than 500 megahertz. Inclusion of these bands would bring consistency across the LMDS band, allowing incumbents to manage both legacy and future services and providing additional 5G spectrum for new entrants. Ericsson also suggests it may be "optimal" for the 28 GHz band to be divided into multiple 100 megahertz or 200 megahertz blocks with separate sets of rules for mobile access and for fixed point-to-multipoint service.[18]

Finally, the Commission effectively embraced 200 megahertz channels when it re-banded the 37 GHz and 39 GHz bands with channels of this size.[19] The Commission has further proposed licensing the 24.25-24.45 GHz band segment as a single, unpaired 200 megahertz block for 5G services, and the 24.75-25.25 GHz band segment as two unpaired blocks of 250 megahertz each.[20] Commenters have recognized that "not all use cases require 500 megahertz of

[17] *See* 3GPP LTE-Advanced. While current LTE and LTE-Advanced deployments typically use (2x2) MIMO on the downlink and no MIMO in the uplink, 5G is expected to support many more antennas than 4 or 8 and 256-QAM. *See also Ex Parte* Letter from Michele C. Farquhar, Counsel to Nextlink Wireless, LLC, to Marlene H. Dortch, FCC, GN Docket No. 14-177, *et al.*, at 3 & n.13 (filed July 8, 2016).

[18] *See* Ericsson Comments at 37. Samsung echoes this proposal. *Ex Parte* Letter from Robert Kubik, Samsung Electronics America, Inc., to Marlene H. Dortch, FCC, GN Docket No. 14-177, at 2-3 (filed Aug. 28, 2015) (recommending a band plan for the LMDS bands with blocks as small as 150 megahertz and 300 megahertz).

[19] *Report and Order* ¶¶ 95-96, 111.

[20] *Further Notice* ¶ 385.

spectrum,"[21] and based on this recognition the Commission went so far as to suggest an alternative proposal of licensing the 24 GHz band in 100 megahertz unpaired channels.[22]

The Commission therefore should not rely on artificial bandwidth concerns to exclude valuable LMDS spectrum from 5G use. Industry experts have largely approved of deploying 5G services over channels smaller than 500 megahertz in bandwidth, and the Commission's own proposals in the *Further Notice* undermine the only stated justification for not making the remainder of the band available for 5G services.

### B. Not adopting mobile service rules for the remaining portions of the LMDS band will orphan this spectrum and potentially create regulatory confusion.

As opposed to the clear benefits that would come from adopting mobile service rules for the 28 GHz A2 and A3 bands and B block, orphaning this 450 megahertz of spectrum—or one-third of the valuable 28 GHz band—will squander precious spectrum resources.

Failing to adopt mobile service rules for these bands for mobile use would trigger the same, or worse, equipment challenges that LMDS licensees faced in the past and would impose significant burdens on licensees. As the Commission is aware, 28 GHz licensees have faced difficulty procuring equipment in the past due to the smaller scale of production for LMDS equipment, rendering network construction and initiation of service economically unfeasible.[23]

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[21] *Id.* ¶ 382 (citing Comments of T-Mobile USA, Inc., GN Docket No. 14-177, *et al.*, at 7 (filed Jan. 27, 2016)).

[22] *Id.* ¶ 385.

[23] *See Applications filed by Licensees in the Local Multipoint Distribution Service (LMDS) Seeking Waivers of Section 101.101 of the Commission's Rules and Extensions of Time to Construct and Demonstrate Substantial Service*, Memorandum Opinion and Order, 23 FCC Rcd. 5894, 5905 ¶ 24 (WTB Apr. 11, 2008) ("We find that the LMDS licensees before us have demonstrated that they faced factors beyond their control, including difficulties in obtaining viable, affordable equipment, that warrant granting a limited extension of time to permit these licensees to continue to build out their licenses."); *see also id.* ¶¶ 5-9 (describing challenges in obtaining LMDS equipment).

When LMDS licensees cannot access equipment, service deployment is delayed and consumers are deprived of the benefit of advanced services. At a minimum, fracturing the 28 GHz band will increase the costs Nextlink and other LMDS licensees will incur to obtain equipment that can operate using the A3 band and B block, especially if treated so disparately from the A1 band.

Making only certain LMDS bands available for mobile use at this stage will cause inefficiencies for manufacturers and providers. Investing in equipment that is only compatible with just the A1 band, for example, is not efficient if the Commission may target the A2 and A3 bands for mobile use in the near future. Rather than creating this chilling effect, the Commission should promote the wireless equivalent of a "dig once" policy for the deployment of equipment that will be used for 5G services—*i.e.*, when a band such as LMDS is opened up for mobile wireless services, the *entire* band should be available for such services so that equipment can be developed for use across the entire band.

In addition, not adopting mobile service rules for the entire LMDS band will create confusing and burdensome regulatory requirements for licensees, particularly vis-à-vis the A1 and A2 band. Currently, the FCC's performance requirement deadlines for incumbent A1 band licensees differs from the deadlines for the A2 and A3 bands and B block (as do the substantive showings incumbent licensees will need to make under the rules). This confusion will only grow to the extent incumbent licensees expand their footprints by bidding on additional 28 GHz licenses at auction. Failing to synchronize these timelines will complicate existing and future deployments, particularly for licensees that use the A1 and A2 bands in tandem.[24]

[24] *Ex Parte* Letter from Michele C. Farquhar, Counsel to Nextlink Wireless, LLC, to Marlene H. Dortch, FCC, GN Docket No. 14-177, *et al*., at 6-7 (filed June 30, 2016).

If the Commission does not authorize mobile services in the remaining LMDS bands, then it should harmonize the license term expiration dates and corresponding substantial service deadlines among the A1, A2, and A3 bands and the B block. Aligning the license terms will provide more certainty for equipment manufacturers and will help minimize some of the inefficiencies resulting from orphaning portions of the LMDS band. Specifically, such alignment means that licensees will be in a better position to engage in efficient equipment planning and deployment across all LMDS blocks.

### C. The entire LMDS Band is suitable for mobile use, but at a minimum the Commission should adopt mobile service rules for the A3 band and B block.

The Commission should adopt mobile service rules for each of the remaining portions of the LMDS band, including the A2 band. While the A2 band may only contain 150 megahertz of spectrum and the current rules limit use of this spectrum to downlink operations,[25] this spectrum would still be a valuable asset for next-generation network operators. Currently, several spectrum bands below 3 GHz are used for supplemental downlink service. For example, the Lower 700 MHz D and E blocks are unpaired blocks used for supplemental downlink.[26] And the upper portion of the AWS-4 band is also included in the first-ever asymmetrical supplemental downlink band plan approved by 3GPP.[27] Nothing suggests that the need for supplemental downlink capacity will lessen as networks transition from 4G to 5G, and network operators (and

[25] *See* 47 C.F.R. § 101.1001.

[26] *See Application of AT&T Inc. and Qualcomm Incorporated for Consent to Assign Licenses and Authorizations*, Order, 26 FCC Rcd. 17589 ¶ 1 (2011).

[27] The upper segment of the AWS-4 band is part of Band 66, which is an asymmetrical band of 70 megahertz uplink and 90 megahertz downlink. *See* Press Release, 3GPP Band Plan Integrates DISH Spectrum, DISH (Dec. 10, 2015), http://about.dish.com/press-release/financial/3gpp-band-plan-integrates-dish-spectrum.

consumers) are likely to benefit from access to supplemental downlink capacity in the mmWave bands.

If, however, the Commission does not include the A2 band in its efforts to promote 5G deployment, the Commission should at least adopt mobile service rules for the A3 band and B block for mobile use. Incumbent licensees and new entrants can easily combine the A3 band and B block to form 300 megahertz of contiguous spectrum for next generation mobile broadband services.[28] For example, Intel previously explained that the A3 band and B block "can be treated as a contiguous block where licensees determine channelization."[29] Nextlink holds both A3 band and B block licenses in many markets, including dense urban centers like New York, Los Angeles, Chicago, and Washington, D.C. where the deployment of 5G services is targeted.[30] Combined, Nextlink's spectrum in these blocks covers nearly 30 percent of the U.S. population.[31] Opening the A3 band and B block for mobile use could bring the benefits of 5G to a significant portion of U.S. consumers.

Moreover, mobile operations in the A3 band and B block would not interfere with neighboring services in the 31.3-31.8 GHz band. The 31.3-31.8 GHz band is allocated to three

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[28] *See* Nextlink, Spectrum Frontiers: Licensing Challenges, GN Docket No. 14-177, at 10 (June 28), *attached to Ex Parte* Letter from Michele C. Farquhar, counsel to Nextlink Wireless, LLC, to Marlene H. Dortch, FCC, GN docket No. 14-177 *et al.*, at 7 (filed June 30, 2016) ("Licensing Challenges Presentation"); *see also Ex Parte* Letter from Joan Marsh, AT&T, to Marlene Dortch, FCC, GN Docket No. 14-177 *et al.*, at 1 (filed June 29, 2016) (urging the FCC to adopt UMFUS in the 28 GHz band and stating "5G development and deployment in the U.S. would best be served by the presence of multiple licensees in 28 GHz").

[29] *See* Dave Horn, *et al.*, Recommendations on the Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, at 13 (Aug. 5, 2015), *attached to Ex Parte* Letter from Dave Horne, Global Public Policy Group, Intel Corp. to Marlene H. Dortch, FCC, GN Docket No. 14-177, *et al*. (filed Aug. 10, 2015).

[30] *See* Licensing Challenges Presentation at 10.

[31] *See id.* at 10 (reporting Nextlink's spectrum holdings in the A3 and B blocks covers 28.5% of the U.S. population based on U.S. Census Bureau 2010 data).

services in the U.S. Table of Allocations: the Radio Astronomy Service (RAS), the Earth Exploration Satellite Service (EESS), and the Space Research Service (SRS). All are passive services; however, RAS receivers are terrestrial while EESS and SRS receivers are satellite-based. The ITU has established protection criteria for RAS and passive EESS.[32]

With respect to RAS, the U.S. Table of Allocations requires that "the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates."[33] The Table also establishes the locations and geographic protection zones around each RAS location.[34] So far, the record does not include any detailed analysis demonstrating that RAS operations cannot be protected as required by U.S. and international regulations. Therefore, it is premature to conclude that mobile operations in 31.0-31.3 GHz would cause harmful interference to RAS.

Engineers cannot rely on traditional 4G system characteristics to determine the deployment restrictions that would ensure interference-free coexistence of nascent 5G mobile technologies because there are fundamental differences between 4G and 5G wave forms, antenna technology, and deployment scenarios. However, the current state of the art suggests that expected interfering emissions will be reduced in a 5G environment as compared to emissions

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[32] *See* International Telecommunication Union, Protection Criteria Used for Radio Astronomical Measurements, May 2003, Recommendation ITU-R RA.769-2; International Telecommunication Union, Studies Related to the Impact of Active Services Allocated in Adjacent or Nearby Bands on Earth Exploration-Satellite-Service (Passive), Aug. 20, 2007, Report ITU-R SM.2092. There is no specific ITU protection criteria for SRS, so the criteria in SM.2092 is assumed to protect both EESS and SRS.

[33] 47 C.F.R. § 2.106, n.US74. Table 1 of RA.769-2 specifies interference thresholds that would be detrimental to radio astronomy continuum observations in each RAS band.

[34] 47 C.F.R. § 2.106, n.US385.

produced by today's 4G deployments. For example, the effects of base station and mobile beamforming and beam tracking on the resulting interference environment must be carefully considered,[35] as well as the effects of frequency localization techniques such as Weighted Overlap Add (WOLA).[36] Although more analysis is needed to show that 5G mobile broadband operations in 31.0-31.3 GHz can protect RAS, the framework is in place both internationally and in the U.S. to guide the process, and it appears very likely that RAS in 31.3-31.8 GHz can be adequately protected through the use of relatively small exclusion zones and modest out-of-band emission limits.[37] The use of guard bands would not be required.

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[35] *See* Qualcomm, *The Promise of 5G mmWave – How Do We Make It Mobile?*, at 11-18 (June 26, 2016), *available at* https://www.qualcomm.com/documents/promise-5g-mmwave-how-do-we-make-it-mobile.

[36] *See* Qualcomm, *Making 5G NR a Reality*, at 21 (Sept. 15, 2016), *available at* https://www.qualcomm.com/documents/making-5g-nr-reality.

[37] Indeed, neither NTIA nor the National Radio Astronomy Observatory has identified any negative effects of mobile use in the A3 band and B block. *See* Comments of NTIA, GN Docket No. 14-177, *et al.*, at 2-3 (filed July 12, 2016) (proposing limitations on band use that would impact RAS observations primarily performed in the 36-37 GHz band, but not for the A2 and A3 bands or B block); Comments of the National Radio Astronomy Observatory, GN Docket No. 14-177, *et al.* (filed Jan. 22, 2016). The National Academy of Sciences' Committee on Radio Frequencies has suggested that prohibiting emissions of any level throughout the entire neighboring band may be unnecessary to protect RAS. Comments of the National Academy of Sciences' Committee on Radio Frequencies, GN Docket No. 14-177, RM-11664, at 4 (filed Jan. 15, 2015) (stating that "RAS bands can be protected regionally by limiting emissions within a certain radius of a facility"). US385 provides the protective radii for RAS operations throughout the country, which, in aggregate, still cover a very small portion of the United States. Further, because nearly all restricted areas cover remote, sparsely populated land, RAS exclusion zones will have little impact on the use of the 31.0-31.3 GHz band for 5G broadband. *See* NTIA, 1390-1392 MHz, at 3 (Mar. 2014), *available at* http://www.ntia.doc.gov/files/ntia/publications/compendium/1390.00-1392.00_01MAR14.pdf; *see also* COMMITTEE ON SCIENTIFIC USE OF RADIO SPECTRUM, SPECTRUM MANAGEMENT FOR SCIENCE IN THE 21ST CENTURY 112, Table 3.1 (National Academies Press 2010), *available at* https://www.nap.edu/read/12800/chapter/5 (listing observatories in Green Bank, West Virginia, Socorro, New Mexico, and 10 Very Long Baseline Array sites throughout the United States among the sites that operate in a range of frequencies that includes the 31.0-31.3 GHz band, whose exclusion zones would apply to LMDS band 5G operators).

Protection of the passive EESS and SRS services may be more challenging, yet still achievable. Satellite-based EESS receives naturally occurring signals in the 31.3-31.8 GHz band using a 45 dBi antenna that produces a narrow beam from an altitude of 850 km such that the receiver's footprint covers a 201 $km^2$ circular area of the earth's surface.[38] The band is used for close-to-nadir atmospheric sounding in conjunction with other passive bands to characterize the layers of the earth's atmosphere.[39] At any given time, multiple 5G base stations and mobile stations may be located within the 201 $km^2$ area of the EESS receive beam. However, as with protection of RAS, no analysis has been submitted to the record that shows that protection of passive EESS from 5G operations in adjacent bands is not achievable.

The ITU has established a methodology to determine the maximum out-of-band emissions from fixed point-to-point and point-to-multipoint operations in adjacent bands such that the required protection limit will be met.[40] This methodology sets the emissions limit from fixed operations into the 31.3-31.8 GHz band at -38 dBW/100 MHz. This limit has been codified in the FCC's rules.[41] A similar methodology could be used to calculate the effect of 5G base and mobile transmissions on EESS receivers, taking into account the effects of beamforming and small cell operations, which will greatly affect the result and conclusion. Specifically, the fundamental premise of mmWave 5G mobile broadband is that energy must be focused between the base station and the mobile device in order to overcome the poor

[38] *See* Rep. ITU-R SM.2092, at 178 (2007), http://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-SM.2092-2007-PDF-E.pdf.

[39] *Id.* at 177.

[40] *Id.* at 180-81.

[41] *See* 47 C.F.R. § 2.106, n.NG60 (stating "[i]n the band 31-31.3 GHz, for stations in the fixed service authorized after August 6, 2018, the unwanted emissions power in any 100 MHz of the 31.3-31.5 GHz Earth exploration-satellite service (passive) band shall be limited to -38 dBW (-38 dBW/100 MHz), as measured at the input to the antenna.").

propagation characteristics of higher frequencies. Thus, in a 5G mobile broadband system at 31.0-31.3 GHz (or at 31.8-33.4 GHz) very little energy will be emitted in the direction of zenith from either mobile or base stations, and thus the interfering power from terrestrial 5G operations will be minimal into the EESS satellite receiver.

Because a detailed engineering analysis has not been submitted to the record, it is premature to conclude that 5G operations should be precluded from the 31.0-31.3 GHz band. Likewise, there is not enough technical data on the record to determine whether any guard band will be required in the 31.0-31.3 GHz and 31.8-33.4 GHz bands to ensure adequate protection of EESS operations in the 31.3-31.8 GHz band. The Commission at a minimum should not foreclose these bands from potential 5G operations.

### D. The Commission has afforded itself latitude to adopt mobile service rules in the remaining portions of the 28 GHz band for mobile use.

Finally, the Commission's iterative process in this proceeding targeting mmWave spectrum bands for next-generation services permits the Commission to adopt mobile rules for the remainder of the LMDS band. In its 2015 *NPRM*, the Commission acknowledged that it would initially focus on the 28, 37 and 39 GHz bands but committed to considering additional bands for mobile use in the future, noting that "the fact that a particular band or bands [were] not considered in [the 2015] *NPRM* [would] not foreclose future Commission action on the band or bands."[42]

There is no procedural obstacle to the Commission adopting flexible use rules for the A2 and A3 bands and B block, even though the proposal was not squarely raised in the *Further Notice*, because the issue has been prominently presented in the record. Nextlink and other

[42] *NPRM* ¶ 20.

commenters raised the issue in response to the 2015 *NPRM*, and including the bands would be a "logical outgrowth" of the issues raised in the *Further Notice*. Courts "will deem a final rule to be a logical outgrowth of a proposed rule 'if a new round of notice and comment would not provide commentators with their first occasion to offer new and different criticisms which the agency might find convincing.'"[43] The D.C. Circuit has explained that "[t]his avoids the 'absurdity . . . that the agency can learn from the comments on its proposals only at the peril of starting a new procedural round of commentary.'"[44]

Here, the Commission sought comment on additional bands that may be suitable for mobile use in three separate notices in this proceeding, and each time alerted parties to the possibility that it would consider even more suggestions on the same issue at a later point in its proceeding.[45] The Commission is "merely doing that which [it] announced" it would do, and all parties have received adequate notice that additional bands, but in particular the LMDS band, are on the table for review.[46] Therefore, there are no procedural barriers to the Commission adopting mobile service rules for the A2 and A3 bands and B block.

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[43] *Daimler Trucks N. Am. v. EPA*, 737 F.3d 95, 100 (D.C. Cir. 2013) (quoting *Int'l Union, United Mine Workers v. Mine Safety & Health Admin.*, 626 F.3d 84, 94 (D.C. Cir. 2010)).

[44] *Id.* (quoting *Small Refiner Lead Phase–Down Task Force v. EPA*, 705 F.2d 506, 546-47 (D.C. Cir.1983)).

[45] *See Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Notice of Inquiry, 29 FCC Rcd. 13020, 1302 ¶¶ 1, 16 (2014); *NPRM* ¶ 14; *Further Notice* ¶ 370.

[46] *Crawford v. FCC*, 417 F.3d 1289, 1296 (D.C. Cir. 2005) (citing *Amendment of Section 73.202(b), Table of Allotments, Fm Broad. Stations. (Benjamin, Texas)*, Memorandum Opinion and Order, 18 FCC Rcd. 103, 104 (AD 2003)); *see also Sprint Corp. v. FCC*, 315 F.3d 369, 373 (D.C. Cir. 2003) ("The court has observed that the notice requirement of the APA does not simply erect arbitrary hoops through which federal agencies must jump without reason. Rather, the notice requirement 'improves the quality of agency rulemaking' by exposing regulations 'to diverse public comment,' ensures 'fairness to affected parties,' and provides a well-developed record that 'enhances the quality of judicial review.' . . . At the same time, agencies possess the

## III. PERFORMANCE REQUIREMENTS

### A. The Commission should only adopt performance requirements that are clear, accommodate unique new technologies, and allow dynamic innovation.

In its *Report and Order*, the Commission adopted performance requirements that allow licensees to meet benchmarks for a specific type of service.[47] The Commission sought comment in its *Further Notice* on additional performance metrics to accommodate new services as well as mixed use cases.[48] The Commission is correct to carefully tailor any performance requirements to accommodate the many types of service the Upper Microwave Flexible Use Service ("UMFUS") bands are expected to support. For example, innovators envision that IoT services will result in billions of new wireless connections, offering network access to anyone and anything.[49] Standards for 5G service have yet to be defined, however, and the future of 5G is not yet clear. As a result, service-specific requirements focused on particular services that exist today may not reflect rapidly changing technologies and business models in the long-term. The Commission can provide licensees with the right balance of regulatory certainty and flexibility by employing clear safe harbors for innovative and mixed use case deployments, in tandem with limited case-by-case review as necessary and a mechanism to reassess and recalibrate the safe harbors as technologies develop.

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authority in some instances to clarify or set aside existing rules without issuing a new NPRM and engaging in a new round of notice and comment.") (citations omitted).

[47] *See Report and Order* ¶ 203.

[48] *Further Notice* ¶¶ 465, 470.

[49] 4G Americas, *Mobile Broadband Transformation: LTE to 5G*, at 1 (Aug. 2016). Nextlink agrees with the Commission that IoT-type services "may or may not be deployed in areas of substantial residential population, and may or may not be designed to serve unaffiliated customers" and therefore a distinct performance requirement may be appropriate for machine-to-machine services. *Further Notice* ¶ 466.

Nextlink proposes a technology-neutral safe harbor of one "installation" or "system" per license area for each of the bands for new technologies and mixed use deployments. This metric would afford licensees the flexibility to deploy the services and technologies that are ready for launch, rather than prioritizing deployment to meet a requirement that may not reflect the nature of the products and services coming to market. This metric would also avoid discriminating against mixed use deployments.

Nextlink also proposes limited use of case-by-case review primarily, to address changes in technology or circumstances beyond a licensee's control. Less predictable case-by-case reviews would impose significant administrative burdens on both the Commission and licensees. Licensees would be required to submit, and the Commission would be required to evaluate, individual performance showings for over 3,000 county-based license areas for the 28 GHz band alone.[50] The Commission's alternative proposed benchmarks for mixed use deployments also falls short.[51] Pre-established scales of acceptable combinations of mobile and fixed deployments that increase the level of one service relative to the other will create artificial restrictions that may distort licensees' investments and business models and delay deployment. In other words, this approach may unintentionally force mixed use licensees to deploy more services than a single-use licensee is required to deploy. A baseline of one installation or system per license area avoids these potential negative consequences.

[50] The Commission has already recognized the issues raised by smaller geographic license areas. For example, the Commission noted in its *2015 Incentive Auction Order* that more service areas could complicate potential bidders' participation in the auction and subsequent service deployment. *See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd. 6567, 6603-04 ¶ 80 (2015).

[51] *Further Notice* ¶ 470.

Regardless of the service or type of deployment, if the Commission balances its performance requirements incorrectly it may deter fruitful innovation and investment because technologies being rolled out in the UMFUS bands are nascent. In its *Further Notice*, the Commission itself acknowledges that its enumerated list of performance metrics "is not exhaustive, and in particular, does not contain metrics designed to accommodate new and innovative services that may develop in the millimeter wave bands."[52] A recalibration mechanism will establish expectations that the Commission can, and likely will, adjust its performance requirements to reflect the developing marketplace and to promote 5G services.

Specifically, a procedure that assesses the adoption of 5G services every five years will ensure that the current performance requirements still adequately reflect 5G developments and are not overly burdensome. The Commission could also seek comment on any proposed amendments to its metrics prior to implementation. The goal of each periodic review would be to establish performance benchmarks that accommodate the current marketplace and better incentivize further deployment, particularly deployment of new and evolving technologies. Such a procedure would help educate the Commission on what is working, and allow stakeholders to play a meaningful role in shaping the regulatory framework that will best encourage 5G development.

### B. The Commission should not adopt a performance benchmark based on the "actual use" of 5G services.

Any performance benchmarks the Commission ultimately adopts for UMFUS licenses should not be based on the "actual use" of 5G services.[53] A wide range of IoT technologies will use 5G networks. Adopting one particular metric, such as the number of devices connected,

[52] *Further Notice* ¶ 465.

[53] *Id.* ¶ 467.

volume of data transmitted, or number of sessions initiated, will discourage deployment of innovative use cases that do not fit squarely within these metrics. Nextlink foresees a vast diversity of possible IoT deployments.[54] As just one example, remote surgery applications are unlikely to involve a large number of devices connected to the network or a large number of "sessions," but would nonetheless be a worthwhile application to utilize UMFUS licenses.[55]

Performance benchmarks based on factors such as transient population at a specific location within a license area would be difficult to administer and should also be eschewed. For example, stakeholders such as CTIA anticipate that mmWave spectrum may be used primarily for adding capacity and high speed data, as opposed to traditional "macro" mobile broadband networks characterized by seamless build-out and coverage.[56] A population- or coverage-based metric would be inappropriate for small cell deployments, which are projected to be one of the main uses for UMFUS frequencies.

The Commission should also be mindful that any performance requirements based on actual use of spectrum will affect a licensee's obligations under its proposed use-or-share regime.

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[54] Nextlink expects a number of IoT applications and use cases to emerge for these bands, including smart parking and traffic congestion management, smart lighting and pollution monitoring, perimeter access and video backhaul for security cameras and sensors, fleet tracking and management, public mass transportation solutions, and precision agriculture services such as crop management and animal tracking, to name a few.

[55] *See, e.g.*, Darrell M. West, *How 5G Technology Enables the Health Internet of Things*, Center for Technology Innovation at Brookings, at 10 (July 2016), https://www.brookings.edu/wp-content/uploads/2016/07/5G-Health-Internet-of-Things_West.pdf (5G will allow surgeons to use virtual tools and mentor physicians from a distance and even use robots to assist in minor procedures); Press Release, Ericsson and King's College London Demonstrate 5G Tactile Robotic Surgery (June 28, 2016), https://www.ericsson.com/news/2023409 (5G enhanced remote surgery using software-defined networking allows medical expertise, diagnosis, and intervention to break geographic boundaries).

[56] Comments of CTIA, GN Docket No. 14-177, *et al.*, at 24 (filed Jan. 28, 2016); Comments of AT&T, GN Docket No. 14-177, *et al.*, at 22-23 (filed Jan. 28, 2016) ("AT&T Comments").

If the Commission adopts the wrong standard, it may allow spectrum "squatters" to share "unused" spectrum that may actually be in use, but not as defined by the Commission.

If, however, the Commission does adopt a performance measurement based on use of services, spectrum lessees' deployments in the band—in addition to the licensee's deployments—should count towards meeting the licensee's benchmark under the performance requirement.[57] Traditionally, a spectrum licensee may attribute to itself the build-out or performance activities of its spectrum lessee(s) for purposes of complying with any applicable performance or build-out requirement.[58] The Commission should explicitly adopt this framework for spectrum leasing in the mmWave bands to provide certainty for UMFUS licensees.

### C. Before adopting an untested use-or-share regime in the UMFUS bands, the Commission must clearly define the terms and establish the mechanism for implementing its sharing proposal.

The Commission should more clearly define the terms and conditions of any sharing policies before adopting them. In its *NPRM*, the Commission proposed opening portions of licensees' spectrum for shared use in license areas that remain unused after five years.[59] Because "many commenters" opposed this regime,[60] and the commenters in favor of a use-or-share

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[57] *Further Notice* ¶ 467.

[58] 47 C.F.R. § 1.9020 (d)(5)(i).

[59] *NPRM* ¶¶ 215-17.

[60] *Further Notice* ¶ 472; *see, e.g.*, AT&T Comments at 20-21 (Jan. 28, 2016); CTIA Comments at 26-27; Comments of High Tech Spectrum Coalition, GN Docket No. 14-177, at 5 (filed Jan. 28, 2016); Comments of Intel, GN Docket No. 14-177, at 20-23 (filed Jan. 27, 2016) ("Intel Comments"); Mobile Future Comments at 16; Comments of NCTA, GN Docket No. 14-177, *et al.*, at 10-11 (filed Jan. 28, 2016); Comments of Nokia, GN Docket No. 14-177, *et al.*, at 20 (filed Jan. 27, 2016) ("Nokia Comments"); Comments of Qualcomm, GN Docket No. 14-177, *et al.*, at 14 (filed Jan. 27, 2016); Comments of TIA, GN Docket No. 14-177, *et al.*, at 26 n.56 (filed

framework did not offer any specifics on how to implement it, the Commission developed only a "limited record" on its proposal.[61] In its *Further Notice*, the Commission sought to further "develop the record" on its use-or-share proposal.[62] And for good reason. Many questions about the use-or-share regime remain unanswered: how to define "unused spectrum," what information should be required to determine whether spectrum is unused, and how to determine what spectrum is unused and how to prevent harmful interference.[63] The Commission should gather detailed proposals from stakeholders to clearly define the necessary terms and establish a mechanism for implementing any such proposal before moving forward. Nextlink supports the Commission's efforts to maximize efficient use of spectrum, but implementing an ambiguous use-or-share obligation will have the opposite effect: it will disincentivize deployment by introducing complications and uncertainty into an already complex and costly process.

### 1. A use-or-share regime will further complicate and delay 5G deployment.

Many parties agree that adding a use-or-share obligation will complicate the roll-out of untested services, making deployment more time-consuming and costly. As AT&T points out, even defining "unused spectrum" will be challenging, as providers may hold capacity in reserve for peak demand periods, making spectrum "use" appear to be very low while in fact the spectrum is fully utilized.[64] Intel echoes this stance, explaining that "[i]n a nascent market like

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Jan. 27, 2016); Comments of Verizon, GN Docket No. 14-177, *et al.*, at 20-21 (filed Jan. 28, 2016).

[61] *Further Notice* ¶ 474 (noting the lack of information "on the substantive issues regarding mechanisms for sharing unused portions of UMFUS licenses").

[62] *Report and Order* ¶ 5; *Further Notice* ¶ 472.

[63] *NPRM* ¶ 217.

[64] AT&T Comments at 20-22.

mmW, it would be difficult to pre-judge fairness of [use] definitions since services are adopted at an unpredictable pace and geographic scope."[65] A use-or-share requirement is premature given that neither the Commission nor industry knows what shape 5G services will ultimately take.[66]

The Commission should refrain from adopting a use-or-share regime at this stage to allow technology and investment to drive 5G deployment rather than performance requirements that may not reflect the state of the marketplace. Carefully tailored license terms and performance requirements that encourage investments in 5G technologies are a better alternative to use-it-or-share-it obligations that will chill investment and innovation.[67] As Nokia explains, parties may be discouraged to buy access to spectrum if they will be required to share it.[68] CTIA states that "licensees will require unfettered access to their licensed service area to test equipment and services. Requiring licensees to share their spectrum with other users while deploying or expanding their networks would undermine and/or delay the provision of service."[69] Other commenters agree and caution against complex systems that will not give licensees exclusive rights.[70]

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[65] Intel Comments at 20-21.

[66] *See, e.g.*, AT&T Comments at 4 ("5G will bring about a seismic shift in how we think about wireless deployments and services. To keep pace with this transformation, the Commission may need to take a fresh look at performance requirement models and develop a new framework for evaluating licensee performance in these mmW bands.").

[67] Nokia Comments at 20; Reply Comments of Nokia, GN Docket No. 14-177, *et al.*, at 4 (Feb. 26, 2016).

[68] Nokia Comments at 20.

[69] CTIA Comments at 26-27.

[70] *See* Comments of 4G Americas, GN Docket No. 14-177, *et al.*, at 4 (filed Jan. 26, 2016) ("4G Americas reiterates the importance of licensing spectrum on an exclusive basis to provide certainty for investment in 5G network deployment."); Intel Comments at 21 ("[T]he uncertain timing of when the licensee might reclaim the spectrum from the sharing party makes for an impractical and uncertain business case for the sharing party.").

Spectrum sharing under the vague approach proposed by the Commission is untested, and if not properly managed and executed could cause harmful interference, undermine network deployments, and delay the roll-out of 5G services.[71] To the extent the Commission plans on applying the dynamic sharing model proposed for the 3.5 GHz band, the Commission has not yet ironed-out the details surrounding the spectrum access system administrators and environmental sensing capability operators to facilitate sharing in that band.[72] As 4G Americas has pointed out in that proceeding, managing spectrum access for competing users in the 3.5 GHz band "would necessarily rely on currently unproven interference management techniques for successful coexistence."[73] Other commenters have expressed similar concerns with the proposed rules for dynamic sharing in the 3.5 GHz band.[74]

A license-by-rule use of shared UMFUS band spectrum is also unlikely to provide adequate protection to incumbent licensees and will be difficult to administer at the boundaries

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[71] *See, e.g.*, Comments of CTIA, GN Docket No. 12-354, at 13 (filed July 14, 2014) (explaining that the Spectrum Access System, a proposed spectrum sharing mechanism, presents "tremendous near-term uncertainty," reflecting "new architectural concepts, protocols, interfaces, stringent security, and policy-enforcement methods").

[72] *See Wireless Telecommunications Bureau and Office of Engineering and Technology Establish Procedure and Deadline for Filing Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Applications*, Public Notice, 30 FCC Rcd. 14170 (OET, WTB Dec. 16, 2015); *Wireless Telecommunications Bureau and Office of Engineering and Technology Extend "First Wave" Filing Deadline for Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Proposals*, Public Notice, 31 FCC Rcd. 3553 (OET, WTB Apr. 14, 2016).

[73] *See* 4G AMERICAS, SPECTRUM SHARING 4, 9-10 (Oct. 2014).

[74] *See, e.g.*, Comments of Google Inc., GN Docket No. 12-354, at 5 (filed July 14, 2014) (opposing the Commission's proposal stating it would "undermin[e] use of the 3.5 GHz band [and] also cloud[] commercial opportunities in other bands where sharing with federal users is possible."); Comments of AT&T, GN Docket No. 12-354, at 2 (filed July 14, 2014) (stating AT&T is "concerned about the complexity of the new and unprecedented" SAS licensing framework and proposing a traditional licensing approach for the 3.5 GHz band).

between "used" and "unused" areas.[75] The Commission will have to pre-judge what constitutes an appropriate pace and geographic scope of deployment and use in order to enforce its use-or-share requirements. By arbitrarily dictating the direction and scope of development, the Commission will likely deter investment in experimental technologies or other services that may not meet the Commission's performance requirements, but could be highly beneficial to the 5G marketplace. The Commission therefore should refrain from adopting a use-or-share framework at this early stage.

### 2. A use-or-share regime strikes the wrong balance by failing to protect licensees' investments.

A poorly calibrated use-or-share regime also could create arbitrage opportunities that would unfairly penalize providers that make significant early investments in technology and deployment. Deploying 5G technologies will require significant investment. Nextlink's significant investments in the LMDS band illustrate the types and levels of investments that will be required. For each new site, Nextlink purchases radios, backhaul, telemetry routers, and pays real estate, permitting, and construction expenses, totaling in the tens of millions of dollars.[76] Moreover, Nextlink has been the industry leader in locating and designing specialized equipment to fit the unique 28 GHz band, which has subsequently been used by other LMDS licensees. Providers investing in innovation, production, and build-out of 5G technologies also take on significant risk. Continuing to drive deployment in the LMDS and other mmWave bands will

[75] *Further Notice* ¶ 481.

[76] *Ex Parte* Letter from Michele C. Farquhar, counsel to Nextlink Wireless, LLC, to Marlene H. Dortch, FCC, GN docket No. 14-177 et al., at 2-3 (June 21, 2016).

require the same dedication and leadership, as well as significant research to develop new technology for the band.[77]

A use-or-share regime risks transferring spectrum rights to another entity that did not invest in buying the spectrum who can opportunistically wait to deploy services once standards and technologies for 5G are more fully developed. In other words, such a framework favors spectrum "trolls" who benefit from licensees' efforts and investments without contributing to the full 5G deployment effort or the initial acquisition of the spectrum itself.

### 3. If adopted, a use-or-share regime should provide licensees with maximum flexibility in building their networks and providing connectivity for next-generation products and services.

If, however, the Commission does adopt a use-or-share regime for UMFUS bands, it should exercise caution in creating the mechanism and setting any benchmarks for triggering spectrum sharing. For example, incumbent licensees should not be forced to disclose competitively sensitive information to entities seeking to share spectrum (particularly where the potential sharee will offer competing services). Further, the complications associated with a use-or-share regime would grow immensely if sharing entities are permitted to operate under different technical rules than the Part 30 rules.[78] And sharing entities must coordinate their deployments with the incumbent licensee, including interference-avoidance strategies.[79] At a minimum, a newcomer/sharee must: (1) operate on a secondary basis and subject to the licensee's primary status; (2) coordinate its operations in the shared portion of the license area

[77] *See Ex Parte* Letter from Michele C. Farquhar, counsel to Nextlink Wireless, LLC, to Marlene H. Dortch, FCC, GN docket No. 14-177 et al., at 4 (June 8, 2016).

[78] *Further Notice* ¶ 477.

[79] *Id.*

with the licensee; and (3) discontinue operations and vacate the spectrum should the licensee decide to expand its coverage area into the then-shared portion of the license area.[80]

Moreover, if a sharing regime is implemented, licensees will need regulatory certainty to determine when and how sharing is triggered. Clear lines will be necessary to protect against the inadvertent release of vital spectrum resources to an opportunistic bystander. As discussed above, the Commission should not adopt a benchmark based on "actual use" of spectrum, as a metric based on the number of end-user customers or the geographic scope of a provider's deployment is inappropriate for many of the services envisioned for 5G.[81] A licensee should not be penalized for building out innovative services that do not conform to traditional performance metrics. If sharing rules are adopted for 28 GHz band licenses, for example, the rules should provide that a county-based license area will not be subject to sharing where the licensee has deployed at least one fixed link or covers at least 20 percent of the population.[82]

The Commission should also carefully consider the mechanism by which a licensee can reclaim its shared spectrum. A licensee must be able to expand its operations with certainty that the sharing user will retreat from the shared spectrum. Absent a clear framework to define and facilitate this process, licensees will not have the incentive to expand their operations and sharing users will hesitate to invest in their temporary spectrum holdings.

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[80] *See id.*

[81] *See supra* Sections III.A, B.

[82] *Further Notice* ¶¶ 479, 481. Finally, as detrimental to spectrum investment and 5G deployment as a use-or-share regime would be, a keep-what-you-use-regime for UMFUS licenses would be worse. Nextlink agrees with the Commission that "[a] . . . drawback of a keep what you use mechanism is that the Commission must reclaim, and later re-auction, the unused portions of the band, which takes time and minimizes a licensee's ability to decide later to deploy in an area . . . ." *Further Notice* ¶ 476. Therefore, a keep-what-you-use regime should be avoided at all costs.

### D. It would be inequitable for the Commission to apply any performance benchmark to license areas that primarily consist of state or federal lands or sensitive areas like military bases.

Certain geographic areas such as state and federal lands and military bases present special challenges for deployment of wireless services. Performance requirements that make it overly burdensome to deploy services in such areas will deter investment in these licenses and slow the deployment of services to these areas. By contrast, performance requirements that account for these unique circumstances will ensure that potential spectrum bidders do not shy away from these licenses and invest in providing services to the remaining portions of the license area.

The Commission has previously declined to include federal lands in its performance requirements.[83] As the Commission has recognized, covering certain government land may be impractical because these lands are subject to restrictions that prevent licensees from providing service, or otherwise make service provision extremely difficult. These lands also often include very small portions of the population, making it challenging to formulate a business case for

[83] *See, e.g., Serv. Rules for the 698-746, 747-762 & 777-792 MHz Bands Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Sys. Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones Biennial Regulatory Review -- Amendment of Parts 1, 22, 24, 27, & 90 to Streamline & Harmonize Various Rules Affecting Wireless Radio Servs. Former Nextel Commc'ns,* Second Report and Order, 22 FCC Rcd. 15289, 15350 ¶ 160 (2007) (when applying geographic benchmarks, licensees were not required to include government lands as part of the relevant service area); *see also Amendment of Parts 1 & 22 of the Commission's Rules with Regard to the Cellular Serv., Including Changes in Licensing of Unserved Area Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27 Interim Restrictions & Procedures for Cellular Serv. Applications,* Notice of Proposed Rulemaking and Order, 27 FCC Rcd. 1745, 1758-59 ¶ 29 (2012) (describing "the Commission's approach in the 700 MHz Service, where certain 700 MHz Service licensees were permitted to exclude 'government lands' from coverage calculation for purposes of compliance with prospective build-out requirements. In the 700 MHz proceeding, the Commission noted the frequent difficulty of, or specific prohibitions barring, in some instances (*e.g.*, a military base), site access to government lands.").

deployment.[84] In order to promote 5G deployment, the Commission should exclude government lands from its performance requirements as it has done before.

## IV. TECHNICAL ISSUES

Finally, Nextlink offers comment and recommendations on several of the technical questions posed in the *Further Notice.*

### A. Downward scaling of maximum power limits for mobile and transportable stations are unnecessary.

Nextlink opposes downward scaling of the maximum power limits that apply to mobile devices.[85] As pointed out in the *Further Notice,* bandwidth scaling factors typically do not apply to mobile transmissions in other bands,[86] and they should not apply to mobile transmissions of future wireless networks, either. Given that 5G technology is nascent, and that the technology is currently being developed to support a myriad of use cases—many of which do not yet exist—regulatory flexibility is a key to the success of 5G. Therefore, establishing power scaling factors based on bandwidth for transportable and mobile stations could inadvertently preclude some use cases that are not yet developed, as well as some that are already envisioned. In addition, specific absorption rate (SAR) limits will likely determine the maximum power limits for mobile devices, regardless of scaling.

### B. The current coordination criteria at market borders for fixed point-to-point operations are overly burdensome due to smaller market sizes.

Nextlink agrees that the current coordination distances that apply under the Commission's rules are incongruent with county-based licensing. Nextlink urges the Commission to adopt alternatives to the existing coordination distances for fixed point-to-point

[84] *See id.*

[85] *Further Notice* ¶ 508.

[86] *Further Notice* ¶ 507

operations that reduce the burdens of coordinating fixed links. For example, the Commission should consider the orientation and power of links, in addition to distance, when setting coordination distances.[87] This could be easily implemented, for example, by finding the path loss at 20 km using free space path loss (FSPL) and setting 20 km as the coordination distance in the direction of the antenna's maximum gain. Using this value for path loss, the FSPL formula could be used to calculate applicable coordination distances in all directions in which the antenna has less than maximum gain, based on the antenna's horizontal pattern. This would give a coordination zone based on the antenna pattern, and if this zone intersects another market, then the licensee would need to coordinate the station with the licensee in that neighboring market. For example, at 28 GHz the FSPL formula gives 147.6 dB of path loss at 20 km. Using this path loss, the distance would be 10 km in directions at which the antenna gain is 6 dB less than maximum. In directions at which the antenna gain is 12 dB less than maximum, the distance would be 5 km. Calculating the distances at 360 points—one for each degree around the station—would be relatively trivial and would produce a coordination zone that more realistically represents the possibility that the station could cause interference to stations in a neighboring market.

## V. CONCLUSION

Nextlink supports the Commission's efforts to unlock additional mmWave spectrum for 5G services. The Commission can enhance its efforts by harmonizing the LMDS band and adopting mobile service rules for the LMDS A2 and A3 bands and the B block. But the untested and vague performance requirements and sharing mechanisms proposed in the *Further Notice* threaten to undermine the Commission's efforts. Nextlink urges the Commission to instead

[87] *Further Notice* ¶ 510.

adopt tailored performance requirements with clear safe harbors and a recalibration mechanism. By doing so, the Commission will maximize the flexible use of LMDS spectrum and enable existing LMDS licensees to bring the extraordinary benefits of 5G to more consumers.

Respectfully submitted,

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